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Water Temperatures of the Nation and Mesilinka River Systems 1996

A. R. Langston
October 1996

PWFWCP Report No. 84

The Peace/Williston Fish & Wildlife Compensation Program is a cooperative venture of BC Hydro and the provincial fish and wildlife management agencies, supported by funding from BC Hydro. The Program was established to enhance and protect fish and wildlife resources affected by the construction of the W.A.C. Bennett and Peace Canyon dams on the Peace River, and the subsequent creation of the Williston and Dinosaur Reservoirs.

Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave. 3rd Floor, Prince George B.C. V2L 3H9

Website: *www.bchydro.bc.ca/environment/initiatives/pwcp/*

This report has been approved by the Peace/Williston Fish and Wildlife Compensation Program Fish Technical Committee.

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INTRODUCTION

During the 1991 summer field season (June - October) rivers within the Williston Reservoir Watershed were investigated to identify a suitable system for a pilot stream fertilization project. Studies of chemical, physical, and biological characteristics of Williston Watershed rivers (Barrett and Halsey 1985, Bruce and Starr 1985, Langston and Blackman 1993) were reviewed and suitable systems selected for preliminary analysis.

The Mesilinka River was selected as the most suitable system for the pilot project of nutrient enrichment. The Nation River was identified as a system which would also benefit greatly from a fertilization program, but would not meet as many of the pilot project objectives as the Mesilinka River (ie. The Mesilinka River is considered to be more representative of the rivers found in the Williston Watershed). Results and methodologies of the 1991 preliminary studies are reported in "Stream fertilization feasibility study 1991 data report" (Langston, 1992).

In 1992 a five year pilot project was initiated on the Mesilinka River to assess the success of a fertilization program on a Northern B.C. interior river system. The project is funded by the Peace/Williston Fish and Wildlife Compensation Program. Program design/implementation and the majority of data collection/analysis is performed by the Ministry of Environment, Lands and Parks Fisheries Research Branch.

This data report summarizes the water temperature data collected from the Mesilinka and Nation Rivers during the summer of 1995. This data is one component of the essential information required to facilitate the proper experimental design of the nutrient enrichment program.

Water temperature data reports (Langston 1992, 1993, 1994, 1995) have been produced for these river systems as part of the Fertilization project initiated in 1992.

STUDY AREA

The Williston watershed is located in north central British Columbia with its southern boundary 40 km. north of Prince George. The watershed area is 70,860 km^2. The study area and rivers examined are depicted in figures 1, 2, and 3. A more detailed description of the study area is available in the "Williston Lake Fisheries Compensation Program management plan" (Blackman et al 1990).

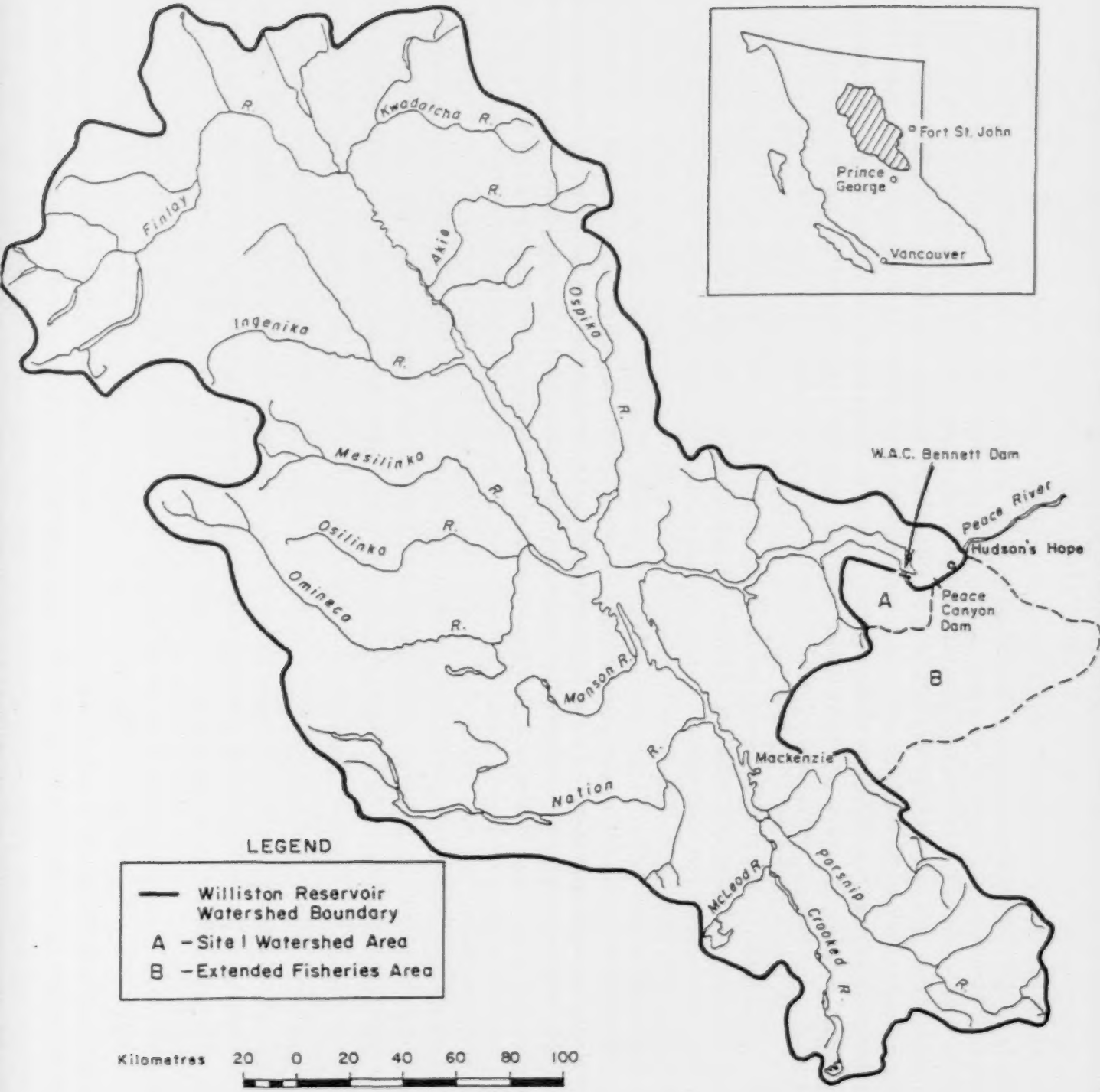

Fort St. John
Prince George
Vancouver
Kwadacha R.
Finlay R.
Akie R.
Ingenika R.
Ospika R.
Mesilinka R.
Osilinka R.
Omineca R.
Manson R.
Nation R.
Mackenzie
McLeod R.
Parsnip R.
Crooked R.
W.A.C. Bennett Dam
Peace River
Hudson's Hope
Peace Canyon Dam
A
B
LEGEND
Williston Reservoir Watershed Boundary
A – Site I Watershed Area
B – Extended Fisheries Area
Kilometres 20 0 20 40 60 80 100

figure 1

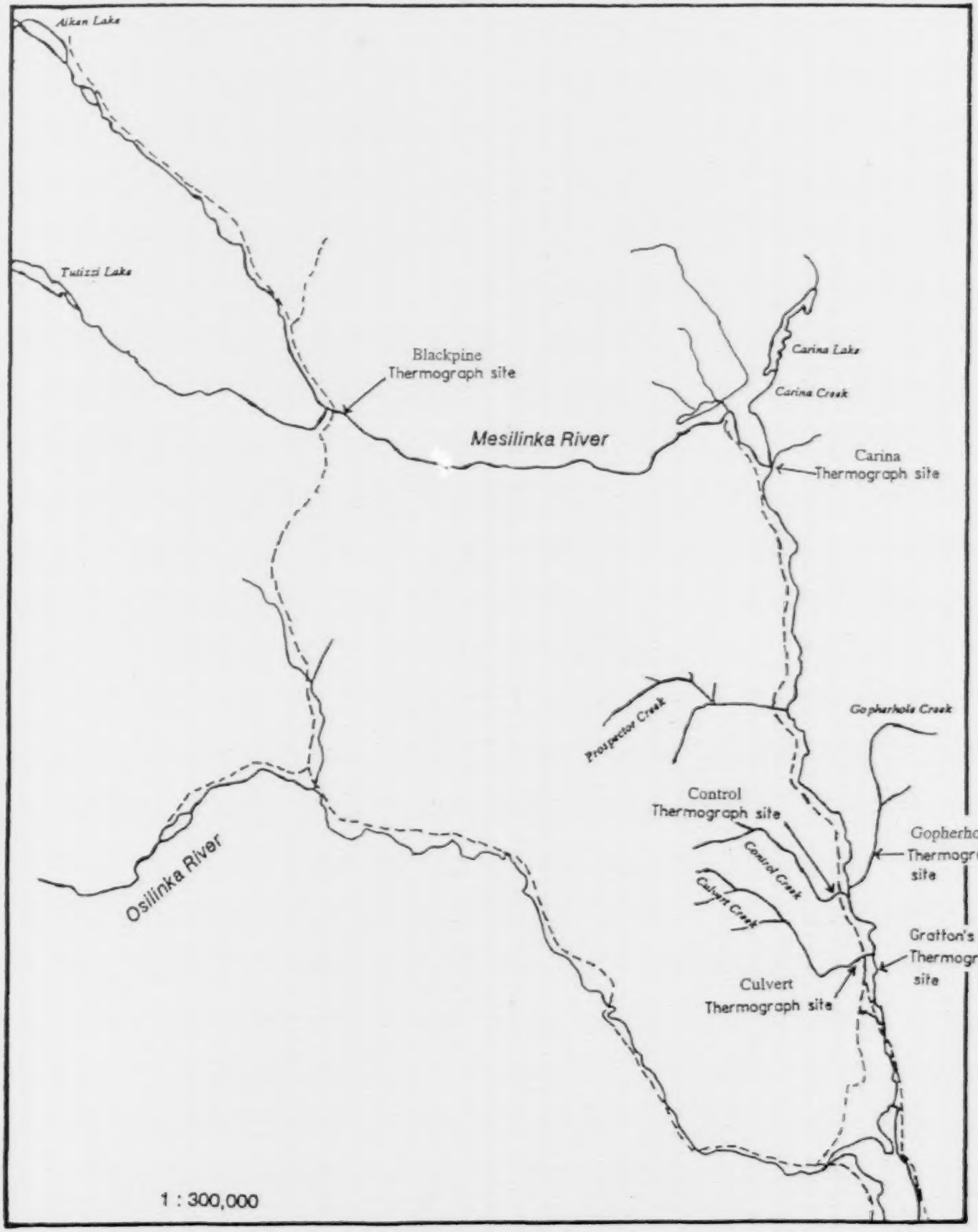
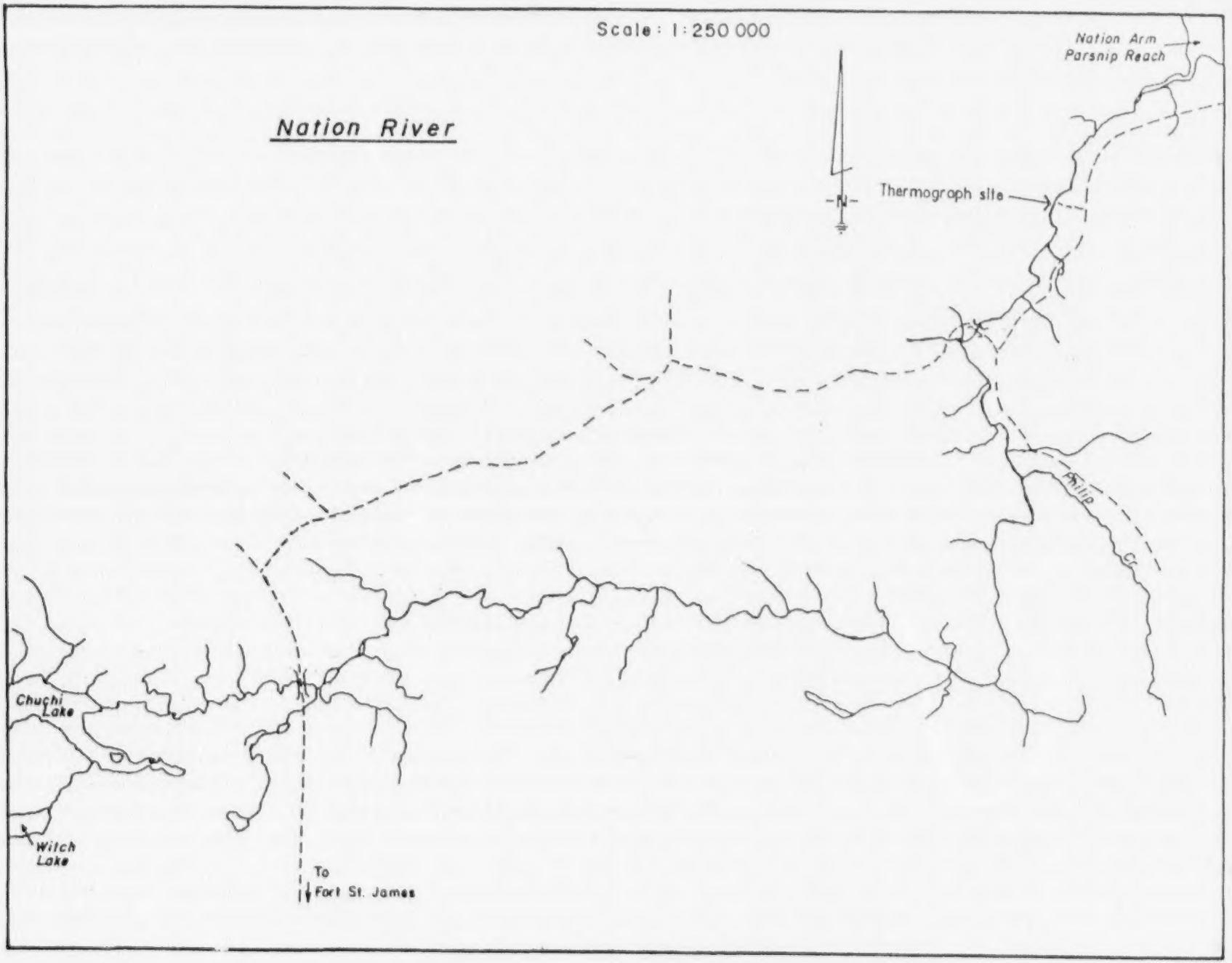

Alkan Lake
Tutizzi Lake
Blackpine
Thermograph site
Mesilinka River
Carina Lake
Carina Creek
Carina
Thermograph site
Prospector Creek
Gopherhole Creek
Control
Thermograph site
Control Creek
Culvert Creek
Gopherhole
Thermograph
site
Gratton's
Thermograph
site
Culvert
Thermograph site
Osilinka River
1 : 300,000

figure 2

figure 3


Scale: 1:250 000
Nation River
Nation Arm
Parsnip Reach
N
Thermograph site
Philip Cr.
Chuchi Lake
Witch Lake
To
Fort St. James

METHODS AND MATERIALS

Water temperatures were monitored at preselected locations (see figure 2 for Mesilinka River system sites) with temperature recording data loggers (Onset Instruments Stowaway miniature data loggers). These units are certified to be accurate to ± 0.2° C. Nation River water temperatures were monitored at the Water Survey of Canada study site (figure 3). The Nation River water temperatures were recorded by a Ryan Instruments Tempmentor. This digital recorder is certified to be accurate to ± 0.3° C. The Temperature Dataloggers were programmed to record water temperatures at two hour sampling intervals. The sites were checked occasionally to ensure the units were completely submerged.

RESULTS

No formal discussion of the results is presented as this data report is intended primarily as an information source only. Water temperature data results are presented in table and graph format. Mean temperatures by: month, and sampling period duration, are summarized and presented in table 1.

Table 1. Mean water temperatures by: month, and sampling period duration.

LOCATION	RECORDING PERIOD	JUNE	JULY	AUG.	DURATION
Blackpine	June 11 - August 25	6.3	7.8	10.0	8.1
Carina	June 11 - August 25	9.5	12.2	13.4	11.9
Control	June 11 - August 25	3.5	6.3	7.4	5.9
Culvert	June 11 - August 25	-	-	-	-
Fatfish	June 11 - August 25	10.1	9.2	6.9	8.7
Gopherhole	June 11 - August 25	4.0	7.1	8.3	6.7
"Gratton's"	June 11 - August 25	7.0	9.2	10.7	9.1
Nation R	July 4 - August 26	-	12.7	14.0	13.4

The Mesilinka River Temperature Datalogger at the Blackpine location was exposed to air temperatures from August 5 - 16 due to receding water levels. The mean water temperatures for this site were calculated excluding the data obtained from the August 5 - 16 period.

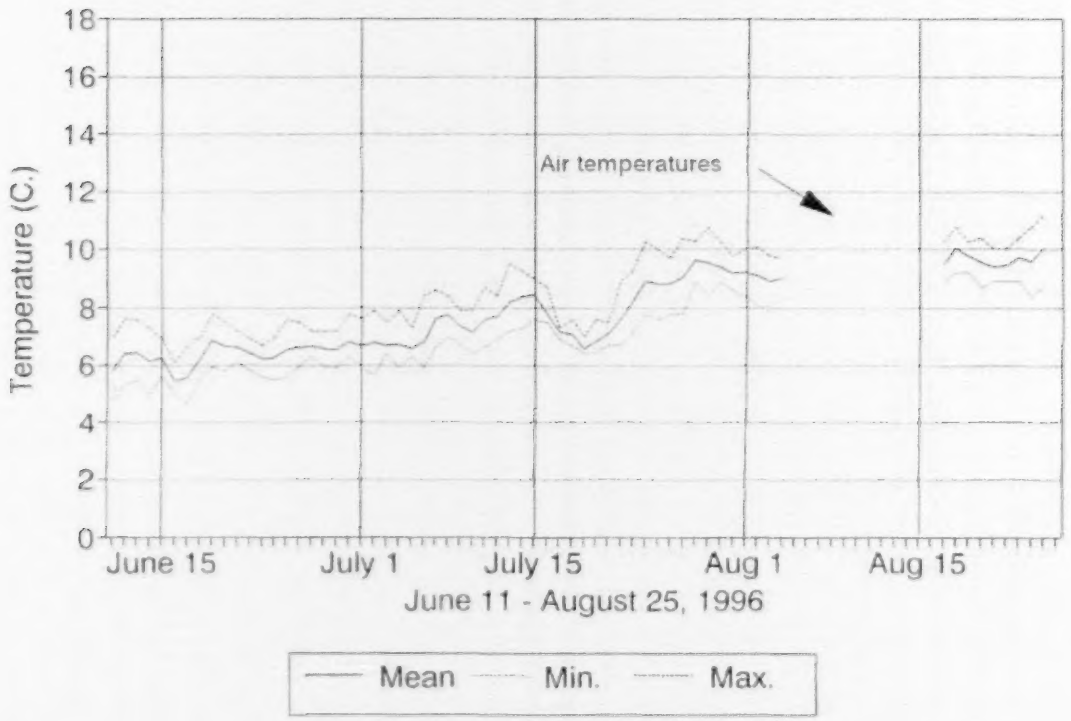
The Mesilinka River Temperature Datalogger at the "Gratton's" location was exposed to air temperatures on August 15 and 16 due to receding water levels. The mean water temperatures for this site were calculated excluding the data obtained from August 15 and 16.

The Culvert Creek Temperature Datalogger was installed on June 11 and retreived August 26. No data was collected by the thermograph. An error or malfunction likely occured in the office during the initialization procedure.

WATER TEMPERATURES OF MESILINKA RIVER AT "BLACKPINE" LOCATION

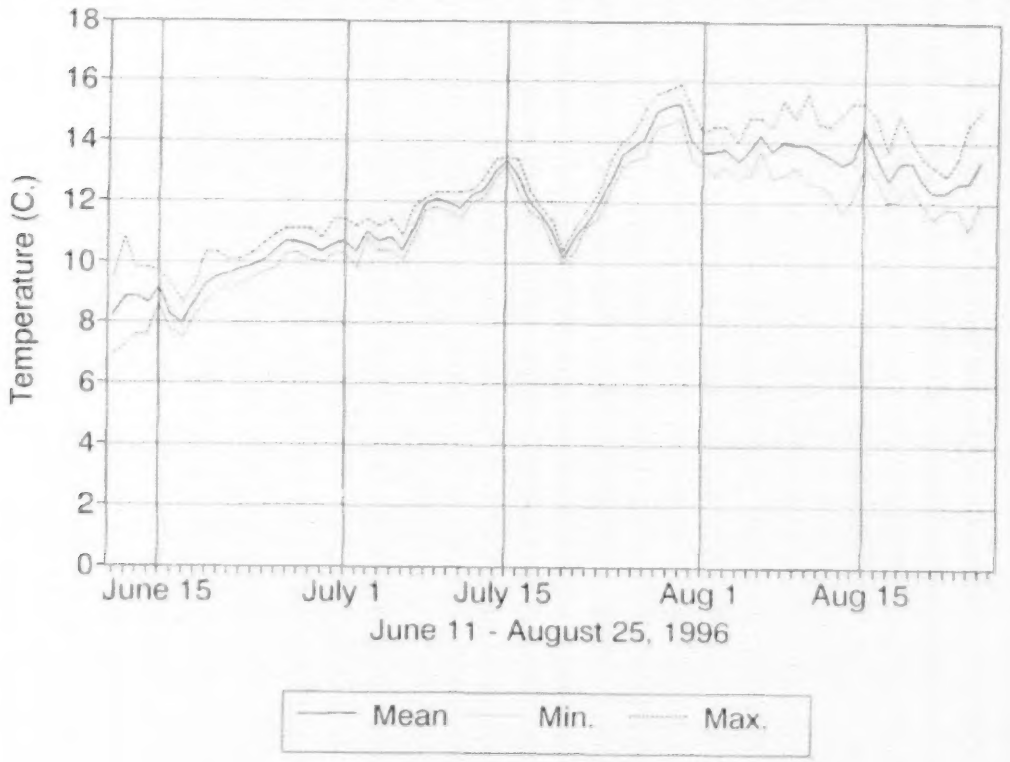
DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.
June 1				July 1	6.7	5.9	7.6	August 1	9.2	8.4	10
June 2				July 2	6.8	5.6	7.9	August 2	9.1	8.1	10.1
June 3				July 3	6.7	6.4	7.5	August 3	8.9	7.9	9.8
June 4				July 4	6.7	5.9	7.9	August 4	9.0	8.4	9.7
June 5				July 5	6.6	6.3	7.3	August 5	10.0	8.1	12.8
June 6				July 6	6.8	5.9	8.4	August 6	12.0	7.6	16.8
June 7				July 7	7.6	6.6	8.6	August 7	10.2	4.5	17
June 8				July 8	7.7	7	8.4	August 8	12.0	6.3	20.6
June 9				July 9	7.4	6.7	7.9	August 9	9.9	7.2	13.2
June 10				July 10	7.1	6.4	7.9	August 10	11.7	7.3	19.2
June 11	5.8	4.8	7	July 11	7.6	6.6	8.7	August 11	9.8	5.6	13.7
June 12	6.4	5.3	7.6	July 12	7.7	6.9	8.4	August 12	10.3	5.5	17.3
June 13	6.4	5.5	7.6	July 13	8.2	7.2	9.5	August 13	10.4	3.1	17.8
June 14	6.2	5	7.3	July 14	8.4	7.3	9.3	August 14	10.2	4.2	18.1
June 15	6.3	5.6	6.9	July 15	8.4	7.6	9	August 15	10.6	6.3	13.7
June 16	5.5	5	6.1	July 16	7.8	7.5	8.7	August 16	9.7	8.6	11.4
June 17	5.6	4.7	6.6	July 17	7.2	6.9	7.3	August 17	9.5	8.9	10.3
June 18	6.2	5.5	7	July 18	7.1	6.7	7.6	August 18	10.1	9.2	10.8
June 19	6.9	5.9	7.8	July 19	6.6	6.4	7	August 19	9.8	9.2	10.3
June 20	6.7	5.8	7.5	July 20	6.9	6.4	7.6	August 20	9.5	8.7	10.4
June 21	6.6	6.1	7.2	July 21	7.1	6.7	7.5	August 21	9.4	8.9	10
June 22	6.4	5.8	6.9	July 22	7.6	6.7	8.9	August 22	9.5	8.9	10
June 23	6.2	5.6	6.7	July 23	8.2	7.2	9.3	August 23	9.7	8.9	10.4
June 24	6.3	5.5	7	July 24	8.9	7.8	10.3	August 24	9.6	8.4	10.8
June 25	6.5	5.6	7.6	July 25	8.8	7.6	10	August 25	10.1	8.7	11.2
June 26	6.6	5.9	7.5	July 26	8.8	7.8	9.7	August 26			
June 27	6.7	6.3	7.2	July 27	9.1	7.8	10.4	August 27			
June 28	6.6	5.9	7.2	July 28	9.6	8.9	10.3	August 28			
June 29	6.5	5.9	7.2	July 29	9.5	8.4	10.8	August 29			
June 30	6.8	6.3	7.8	July 30	9.4	8.9	10.3	August 30			
				July 31	9.2	8.6	9.8	August 31			

*shaded entries represent dates thermograph was above water surface and collecting air temperatures.



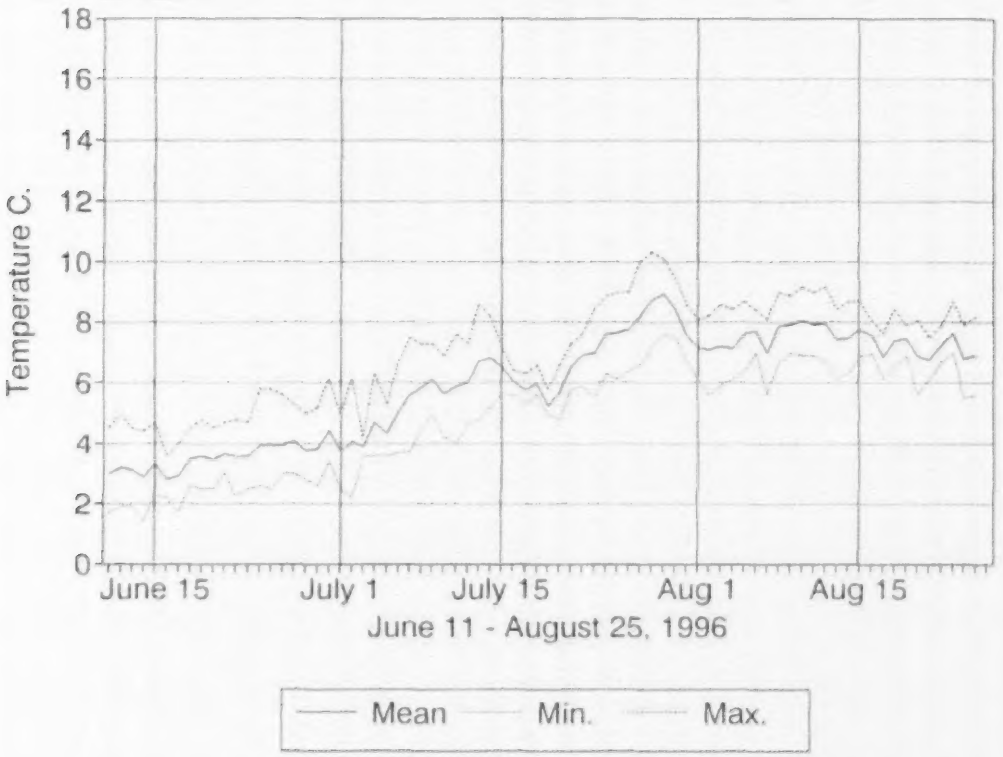
WATER TEMPERATURES AT CARINA CREEK 1996

DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.
June 1				July 1	10.7	10.3	11.4	August 1	13.7	13.2	14.3
June 2				July 2	10.4	9.8	11.2	August 2	13.7	12.9	14.5
June 3				July 3	11.0	10.8	11.4	August 3	13.8	13.2	14.5
June 4				July 4	10.7	10.4	11.2	August 4	13.4	12.8	14
June 5				July 5	10.8	10.4	1 1.4	August 5	13.7	12.9	14.8
June 6				July 6	10.4	10.1	10.9	August 6	14.2	13.7	14.8
June 7				July 7	11.1	10.8	11.8	August 7	13.7	12.8	14.5
June 8				July 8	1 1.9	1 1.7	12.1	August 8	14.0	12.9	15.4
June 9				July 9	12.1	1 1.8	12.3	August 9	13.9	13.2	14.8
June 10				July 10	12.0	11.7	12.3	August 10	13.9	12.6	15.6
June 11	8.2	7	9.5	July 1 1	11.8	11.4	12.3	August 1 1	13.7	12.6	14.6
June 12	8.9	7.2	10.8	July 12	12.2	12	12.4	August 12	13.5	12.4	14.5
June 13	8.9	7.6	9.8	July 13	12.4	12.1	12.8	August 1 3	13.3	11.7	14.9
June 14	8.7	7.6	9.8	July 14	13.0	12.8	13.4	August 14	13.5	12.1	15.3
June 1 5	9.1	8.6	9.7	July 15	13.4	13.2	13.5	August 1 5	14.4	13.2	15.3
June 1 6	8.3	7.8	9.3	July 16	12.9	12.4	13.4	August 16	13.5	12.8	14.8
June 17	8.0	7.5	8.7	July 17	12.0	11.7	12.4	August 17	12.8	12	13.7
June 18	8.7	8.2	9.3	July 18	11.6	11.4	11.8	August 18	13.3	12.1	14.9
June 19	9.3	8.7	10.3	July 19	11.1	10.6	11.4	August 19	13.4	12.6	14.1
June 20	9.5	9	10.3	July 20	10.2	10	10.4	August 20	12.7	12	13.5
June 21	9.6	9.3	10.1	July 21	10.8	10.4	1 1.1	August 21	12.3	11.5	13.2
June 22	9.8	9.3	10.1	July 22	11.3	11.2	11.7	August 22	12.3	11.8	12.9
June 23	9.9	9.5	10.3	July 23	11.9	1 1.5	12.3	August 23	12.6	11.8	13.5
June 24	10.0	9.7	10.6	July 24	12.7	12.4	13.4	August 24	12.7	11.1	14.6
June 25	10.4	9.8	10.9	July 25	13.6	13.2	14	August 25	13.4	12	15.1
June 26	10.7	10.3	11.1	July 26	13.8	13.4	14.3	August 26			
June 27	10.6	10.3	1 1.1	July 27	14.1	13.5	15.1	August 27			
June 28	10.6	10.1	11.1	July 28	15.0	14.5	15.6	August 28			
June 29	10.3	10	10.8	July 29	15.2	14.6	15.7	August 29			
June 30	10.6	10.3	11.4	July 30	15.3	14.8	15.9	August 30			
				July 31	14.0	13.4	15.1	August 31			



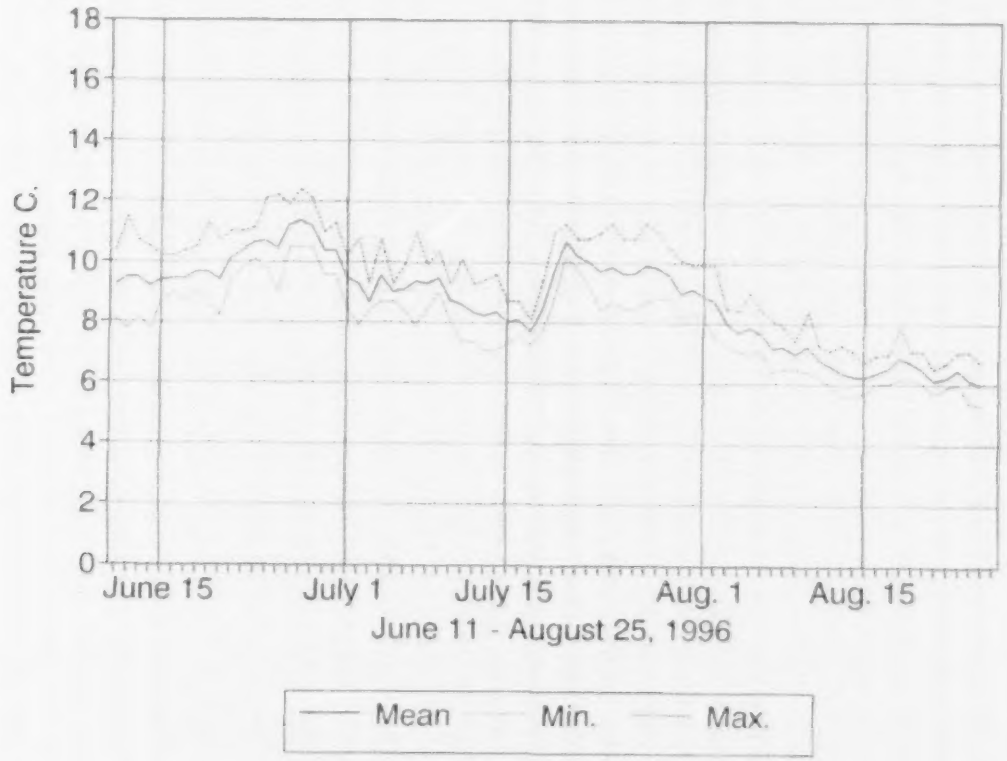
WATER TEMPERATURES AT CONTROL CREEK 1996

DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.
June 1				July 1	3.7	2.5	5	August 1	7.2	6.1	8.1
June 2				July 2	4.1	2.2	6.1	August 2	7.1	5.6	8.2
June 3				July 3	3.9	3.6	4.2	August 3	7.2	5.9	8.6
June 4				July 4	4.7	3.6	6.3	August 4	7.1	6.1	8.4
June 5				July 5	4.3	3.6	5.3	August 5	7.6	6.4	8.7
June 6				July 6	5.1	3.7	6.7	August 6	7.7	7	8.4
June 7				July 7	5.6	3.7	7.5	August 7	7.0	5.6	8.1
June 8				July 8	5.8	4.5	7.3	August 8	7.9	6.7	9
June 9				July 9	6.1	5	7.3	August 9	8.0	7	8.9
June 10				July 10	5.7	4.2	6.9	August 10	8.0	6.9	9.2
June 11	3.0	1.7	4.5	July 11	5.9	4	7.6	August 11	8.0	6.9	9
June 12	3.2	1.9	5	July 12	6.0	4.7	7.3	August 12	8.0	6.7	9.2
June 13	3.1	1.9	4.5	July 13	6.7	4.8	8.6	August 13	7.4	6.1	8.4
June 14	2.9	1.4	4.4	July 14	6.8	5.2	8.2	August 14	7.5	6.3	8.7
June 15	3.3	2.3	4.7	July 15	6.5	5.6	7.2	August 15	7.8	6.9	8.7
June 16	2.8	2.2	3.6	July 16	6.0	5.6	6.4	August 16	7.6	7	8.1
June 17	2.9	1.7	4	July 17	5.7	5.3	6.3	August 17	6.9	6.1	7.6
June 18	3.5	2.6	4.5	July 18	6.0	5.6	6.6	August 18	7.4	6.6	8.4
June 19	3.6	2.5	4.8	July 19	5.3	5	5.8	August 19	7.5	6.9	7.9
June 20	3.4	2.5	4.5	July 20	5.7	4.8	6.6	August 20	6.9	5.6	8.1
June 21	3.6	3	4.7	July 21	6.5	5.8	7.3	August 21	6.7	6.1	7.5
June 22	3.6	2.3	4.8	July 22	6.9	5.9	7.6	August 22	7.2	6.7	7.9
June 23	3.6	2.5	4.7	July 23	7.0	5.5	8.4	August 23	7.7	7	8.7
June 24	3.9	2.6	5.8	July 24	7.6	6.3	8.9	August 24	6.8	5.5	7.9
June 25	3.9	2.5	5.8	July 25	7.6	6.1	9	August 25	6.9	5.6	8.2
June 26	3.9	3	5.6	July 26	7.8	6.4	9	August 26			
June 27	4.1	3	5.3	July 27	8.2	6.6	10	August 27			
June 28	3.8	2.8	5	July 28	8.8	7.2	10.3	August 28			
June 29	3.8	2.6	5.2	July 29	9.0	7.6	10.1	August 29			
June 30	4.4	3.4	6.1	July 30	8.4	7.5	9.5	August 30			
				July 31	7.6	6.7	8.6	August 31			



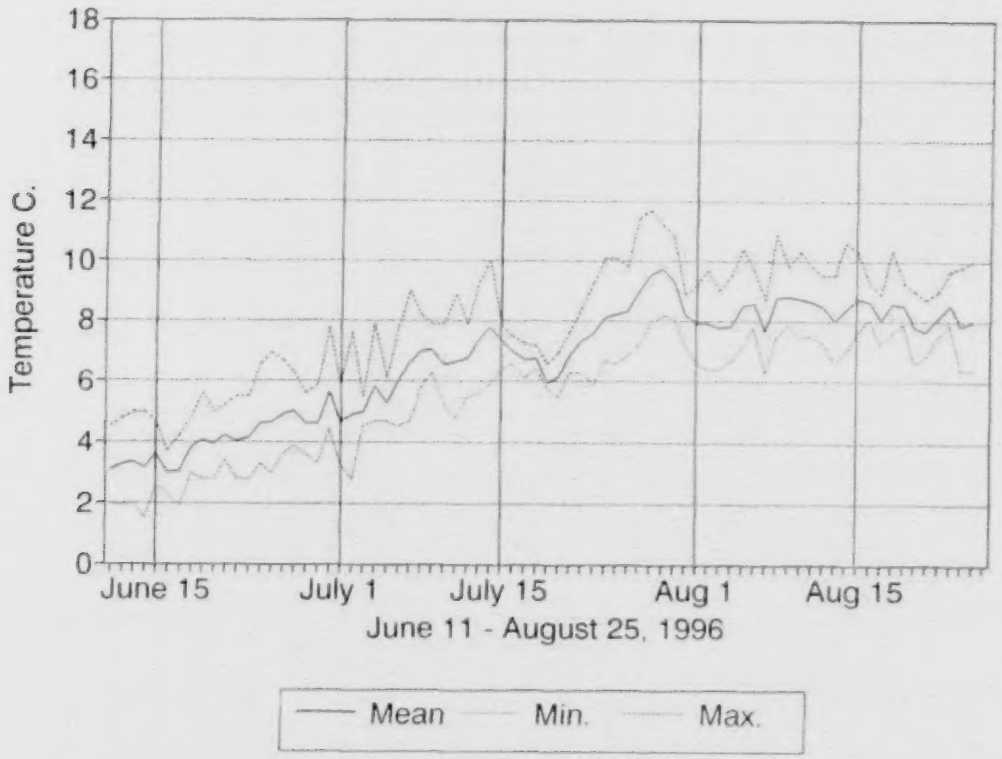
WATER TEMPERATURES AT FATFISH CREEK 1996

DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.
June 1				July 1	9.5	8.5	10.2	August 1	8.9	8.1	9.9
June 2				July 2	9.3	7.9	10.8	August 2	8.7	7.6	9.9
June 3				July 3	8.7	8.4	9.3	August 3	8.0	7.3	8.5
June 4				July 4	9.6	8.7	10.8	August 4	7.7	7.1	8.4
June 5				July 5	9.0	8.7	9.3	August 5	7.9	7	9
June 6				July 6	9.1	8.4	9.9	August 6	7.7	7.1	8.4
June 7				July 7	9.4	7.9	11	August 7	7.2	6.4	8.1
June 8				July 8	9.3	8.5	9.9	August 8	7.2	6.5	7.9
June 9				July 9	9.5	9	10.4	August 9	7.0	6.5	7.4
June 10				July 10	8.7	8.1	9.3	August 10	7.2	6.4	8.4
June 11	9.2	8.1	10.4	July 11	8.6	7.4	10.1	August 11	6.8	6.2	7.3
June 12	9.5	7.8	11.5	July 12	8.3	7.4	9.3	August 12	6.6	6	7.1
June 13	9.5	8.2	10.7	July 13	8.3	7.1	9.4	August 13	6.4	5.6	7.3
June 14	9.2	7.8	10.5	July 14	8.3	7.1	9.6	August 14	6.3	5.6	7.1
June 15	9.4	8.7	10.2	July 15	8.0	7.3	8.7	August 15	6.2	5.7	6.7
June 16	9.5	9	10.2	July 16	8.1	7.6	8.7	August 16	6.4	6	7
June 17	9.4	8.7	10.4	July 17	7.7	7.3	8.1	August 17	6.5	6	7
June 18	9.7	9	10.5	July 18	8.5	7.8	9.4	August 18	6.9	6.2	7.9
June 19	9.7	8.7	11.3	July 19	9.7	8.8	11	August 19	6.7	6.2	7.1
June 20	9.4	8.2	10.7	July 20	10.7	10.2	11.3	August 20	6.5	6	7.1
June 21	10.1	9.4	11	July 21	10.3	9.8	10.8	August 21	6.1	5.7	6.5
June 22	10.4	9.8	11	July 22	10.0	9.3	10.8	August 22	6.2	5.9	6.7
June 23	10.6	10.1	11.1	July 23	9.7	8.4	11	August 23	6.5	6	7.1
June 24	10.7	9.8	12.1	July 24	9.8	8.7	11.3	August 24	6.1	5.4	7.1
June 25	10.5	9	12.2	July 25	9.6	8.5	10.8	August 25	6.0	5.3	6.7
June 26	11.2	10.5	11.9	July 26	9.6	8.5	10.8	August 26			
June 27	11.4	10.5	12.4	July 27	9.9	8.7	11.3	August 27			
June 28	11.2	10.5	12.1	July 28	9.8	8.8	11	August 28			
June 29	10.4	9.6	11	July 29	9.6	8.8	10.5	August 29			
June 30	10.4	9.6	11.3	July 30	9.0	8.1	10.1	August 30			
				July 31	9.1	8.4	9.9	August 31			



WATER TEMPERATURES AT GOPHERHOLE CREEK 1996

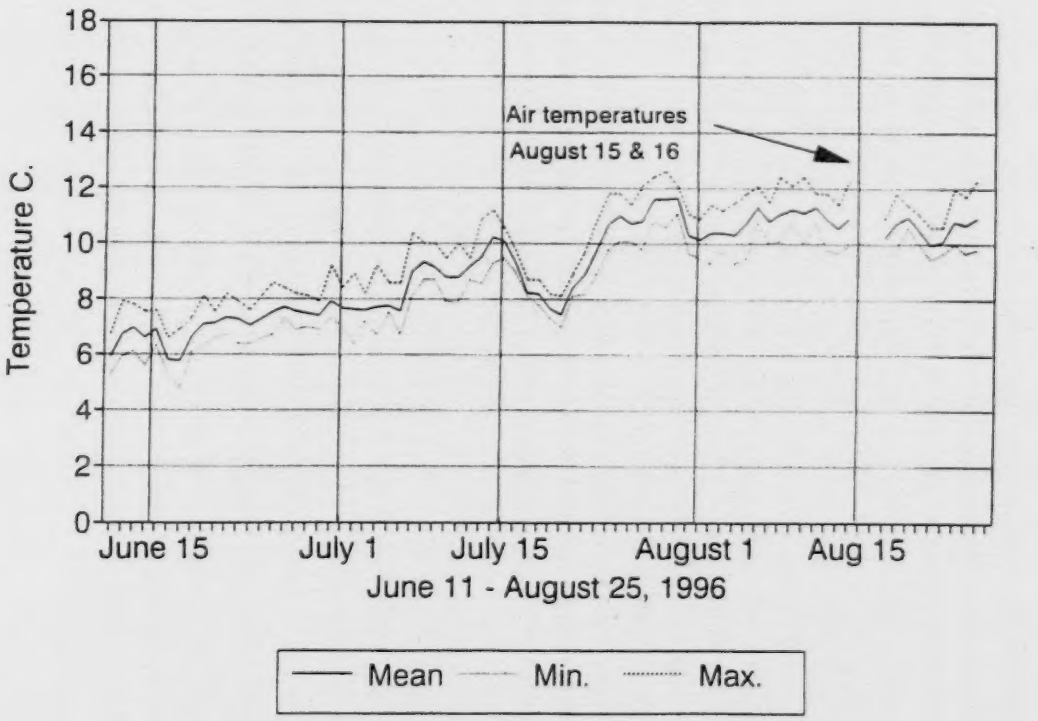
DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.
June 1				July 1	4.7	3.3	5.9	August 1	8.0	6.6	9.2
June 2				July 2	4.9	2.8	7.6	August 2	7.9	6.4	9.7
June 3				July 3	5.0	4.5	5.5	August 3	7.8	6.4	9
June 4				July 4	5.8	4.7	7.9	August 4	7.8	6.7	9.5
June 5				July 5	5.3	4.7	6.1	August 5	8.5	7.2	10.4
June 6				July 6	6.0	4.5	7.8	August 6	8.6	7.8	9.7
June 7				July 7	6.6	4.7	9	August 7	7.7	6.3	8.7
June 8				July 8	7.0	5.8	8.2	August 8	8.8	7.5	10.9
June 9				July 9	7.1	6.3	7.9	August 9	8.8	7.9	9.8
June 10				July 10	6.5	5.2	7.9	August 10	8.7	7.5	10.3
June 11	3.1	2	4.5	July 11	6.7	4.8	8.9	August 11	8.7	7.5	9.8
June 12	3.3	1.9	4.8	July 12	6.8	5.5	7.9	August 12	8.5	7.3	9.5
June 13	3.4	2	5	July 13	7.4	5.6	9.3	August 13	8.0	6.6	9.5
June 14	3.2	1.5	5	July 14	7.8	5.9	10	August 14	8.4	7	10.6
June 15	3.6	2.6	4.7	July 15	7.4	6.4	7.9	August 15	8.7	7.6	10.3
June 16	3.0	2.3	3.7	July 16	7.0	6.6	7.5	August 16	8.7	8.1	9.3
June 17	3.1	1.9	4.2	July 17	6.7	6.1	7.3	August 17	8.1	7.3	8.9
June 18	3.8	3	4.8	July 18	6.8	6.4	7.2	August 18	8.6	7.6	10.4
June 19	4.1	2.8	5.6	July 19	6.0	5.8	6.6	August 19	8.5	7.9	9.3
June 20	3.9	2.8	5	July 20	6.2	5.5	7	August 20	7.8	6.6	9
June 21	4.2	3.4	5.2	July 21	6.9	6.3	7.6	August 21	7.7	6.9	8.7
June 22	4.0	2.8	5.5	July 22	7.4	6.3	8.4	August 22	8.1	7.5	9
June 23	4.2	2.8	5.5	July 23	7.6	5.9	9.3	August 23	8.6	7.9	9.7
June 24	4.6	3.3	6.6	July 24	8.1	6.7	10.1	August 24	7.9	6.4	9.8
June 25	4.7	3	7	July 25	8.2	6.6	10.1	August 25	8.0	6.4	10
June 26	4.9	3.6	6.7	July 26	8.3	6.9	9.8	August 26			
June 27	5.0	3.9	6.3	July 27	9.0	7.2	11.4	August 27			
June 28	4.6	3.6	5.6	July 28	9.6	7.9	11.7	August 28			
June 29	4.6	3.3	5.9	July 29	9.7	8.2	11.2	August 29			
June 30	5.6	4.4	7.8	July 30	9.3	8.1	10.8	August 30			
				July 31	8.2	7.3	8.9	August 31			



WATER TEMPERATURES OF MESILINKA RIVER AT "GRATTON'S" LOCATION

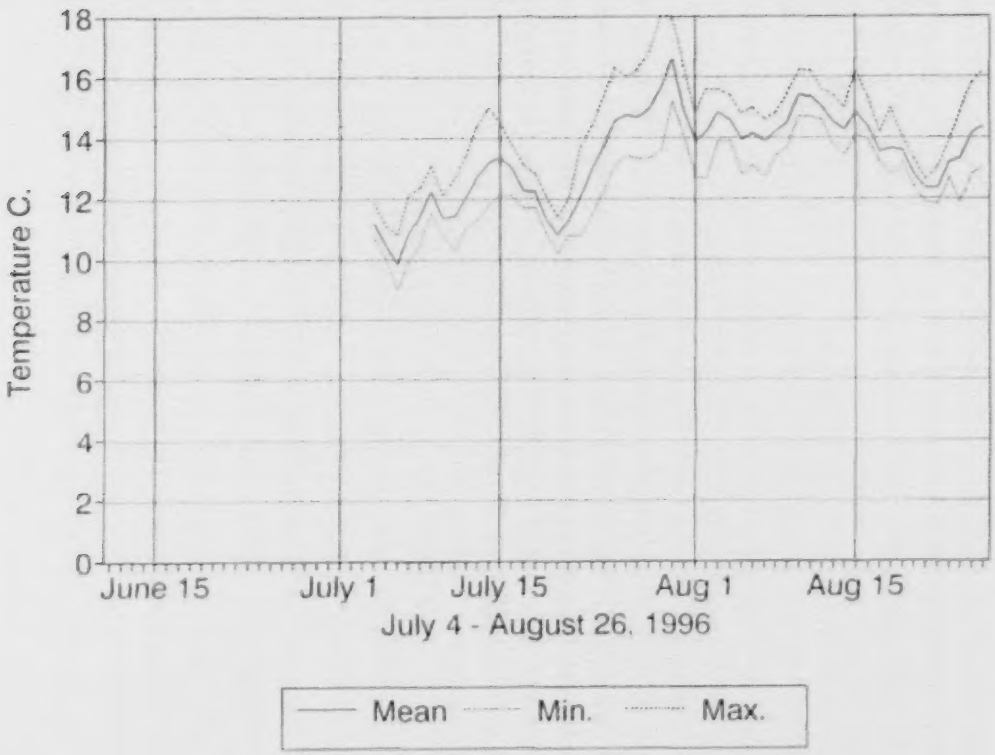
DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.
June 1				July 1	7.7	7	8.4	August 1	10.2	9.5	10.9
June 2				July 2	7.6	6.4	8.9	August 2	10.4	9.3	11.4
June 3				July 3	7.6	7.2	8.2	August 3	10.4	9.8	11.2
June 4				July 4	7.7	6.7	9.2	August 4	10.3	9.3	11.5
June 5				July 5	7.8	7.5	8.6	August 5	10.7	9.5	11.8
June 6				July 6	7.6	6.7	8.6	August 6	11.3	10.8	12.1
June 7				July 7	9	8.1	10.4	August 7	10.8	10	11.5
June 8				July 8	9.4	8.7	10	August 8	11.1	10.1	12.4
June 9				July 9	9.2	8.7	10	August 9	11.2	10.8	12.1
June 10				July 10	8.8	7.9	9.5	August 10	11.1	10	12.4
June 11	5.9	5.3	6.7	July 11	8.8	7.9	10	August 11	11.3	10.8	11.8
June 12	6.7	5.9	7.9	July 12	9.2	8.7	9.5	August 12	10.9	9.8	11.8
June 13	7	6.1	7.8	July 13	9.5	8.6	10.9	August 13	10.6	9.7	11.4
June 14	6.6	5.6	7.5	July 14	10.2	9.3	11.2	August 14	10.9	10	12.3
June 15	6.9	6.3	7.6	July 15	10.1	9.5	10.6	August 15	11.4	8.4	14
June 16	5.8	5.3	6.6	July 16	9.4	9	9.8	August 16	10.3	8.7	11.8
June 17	5.7	4.8	6.9	July 17	8.2	8.1	8.7	August 17	10.3	9.5	10.9
June 18	6.6	6.1	7.3	July 18	8.2	7.8	8.7	August 18	10.7	9.8	11.8
June 19	7.1	6.3	8.1	July 19	7.7	7.3	8.2	August 19	11	10.6	11.4
June 20	7.1	6.6	7.5	July 20	7.5	7	8.1	August 20	10.5	10	11.1
June 21	7.3	6.7	8.2	July 21	8.4	8.1	8.9	August 21	10	9.5	10.6
June 22	7.3	6.4	7.9	July 22	8.9	8.2	9.7	August 22	10.1	9.7	10.6
June 23	7	6.4	7.6	July 23	9.7	8.9	10.8	August 23	10.8	10	12
June 24	7.3	6.6	8.1	July 24	10.7	9.8	11.8	August 24	10.7	9.7	11.7
June 25	7.5	6.7	8.6	July 25	11	10.1	11.8	August 25	10.9	9.8	12.3
June 26	7.7	7.3	8.4	July 26	10.7	10.1	11.4	August 26			
June 27	7.6	6.9	8.2	July 27	10.8	9.8	12.1	August 27			
June 28	7.5	7	8.1	July 28	11.6	10.8	12.4	August 28			
June 29	7.4	6.9	7.9	July 29	11.6	10.6	12.6	August 29			
June 30	8	7.3	9.2	July 30	11.6	11.1	12.1	August 30			
				July 31	10.3	9.7	11.1	August 31			

*shaded entries represent dates thermograph was above water surface and collecting air temperatures.



WATER TEMPERATURES OF THE NATION RIVER 1996

DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.	DATE	MEAN	MIN.	MAX.
June 1				July 1				August 1	13.9	12.7	14.8
June 2				July 2				August 2	14.2	12.7	15.6
June 3				July 3				August 3	14.8	13.9	15.6
June 4				July 4	11.2	10.8	11.9	August 4	14.6	13.9	15.4
June 5				July 5	10.5	10	11.1	August 5	13.9	12.8	14.8
June 6				July 6	9.9	9	10.8	August 6	14.1	13.1	15
June 7				July 7	10.9	10	12.1	August 7	13.9	12.7	14.6
June 8				July 8	11.5	10.5	12.4	August 8	14.2	13.4	14.8
June 9				July 9	12.2	11.6	13.1	August 9	14.5	13.7	15.4
June 10				July 10	11.4	10.8	12.1	August 10	15.4	14.7	16.2
June 11				July 11	11.4	10.3	12.7	August 11	15.4	14.7	16.2
June 12				July 12	12.1	11.1	13.4	August 12	15.0	14.6	15.6
June 13				July 13	12.7	11.3	14.4	August 13	14.5	13.8	15.4
June 14				July 14	13.2	11.8	15	August 14	14.2	13.4	15
June 15				July 15	13.3	12.1	14.5	August 15	14.8	14.1	16.2
June 16				July 16	13.0	12.1	13.8	August 16	14.4	13.9	15.3
June 17				July 17	12.2	11.7	13.1	August 17	13.5	13.2	14.2
June 18				July 18	12.2	11.7	12.8	August 18	13.6	12.8	15
June 19				July 19	11.3	10.9	12.1	August 19	13.6	13.2	14
June 20				July 20	10.8	10.2	11.4	August 20	12.8	12.4	13.3
June 21				July 21	11.3	10.8	12	August 21	12.3	11.9	12.6
June 22				July 22	12.0	10.8	13.7	August 22	12.3	11.8	13
June 23				July 23	13.0	11.5	14.4	August 23	13.2	12.7	13.9
June 24				July 24	13.8	12.3	15.3	August 24	13.3	11.9	14.8
June 25				July 25	14.5	13.1	16.3	August 25	14.2	12.8	15.8
June 26				July 26	14.8	13.4	16	August 26	14.4	13	16.2
June 27				July 27	14.7	13.3	16.2	August 27			
June 28				July 28	14.9	13.3	16.8	August 28			
June 29				July 29	15.6	13.6	18	August 29			
June 30				July 30	16.6	15.2	17.9	August 30			
				July 31	14.9	14.1	16.4	August 31			



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